Name _____ Date _____ Period _____

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Beer-Lambert Law

AP Chemistry | Topic 3.13

Answer each question in the space provided. Show your work with units and correct significant figures.
Beer-Lambert law: $A = \varepsilon bc$

1. Identify each variable in the Beer-Lambert law and give its units. Write *none* if it has no units.

Symbol	What it represents	Units
A		
ε		
b		
c		

2. A solution of a colored compound has an absorbance of **0.40** in a 1.00 cm cuvette. Predict the new absorbance for each change. Make each change separately, starting from the original solution.

(a) The concentration is doubled.

(b) A 0.500 cm cuvette is used instead.

(c) 10.0 mL of the solution is diluted to 40.0 mL.

(d) Describe the relationship between A and c. On a graph of A versus c, what quantity equals the slope?

3. Potassium permanganate, $KMnO_4$, has a molar absorptivity of $2.40 \times 10^3\ M^{-1}\ cm^{-1}$ at 525 nm. Calculate the absorbance of a 1.50×10^{-4} M $KMnO_4$ solution in a 1.00 cm cuvette.

4. Red 40 dye has a molar absorptivity of $2.50 \times 10^4\ M^{-1}\ cm^{-1}$ at 504 nm. A sample of fruit punch has an absorbance of 0.520 at 504 nm in a 1.00 cm cuvette. Calculate the concentration of Red 40 in the punch.

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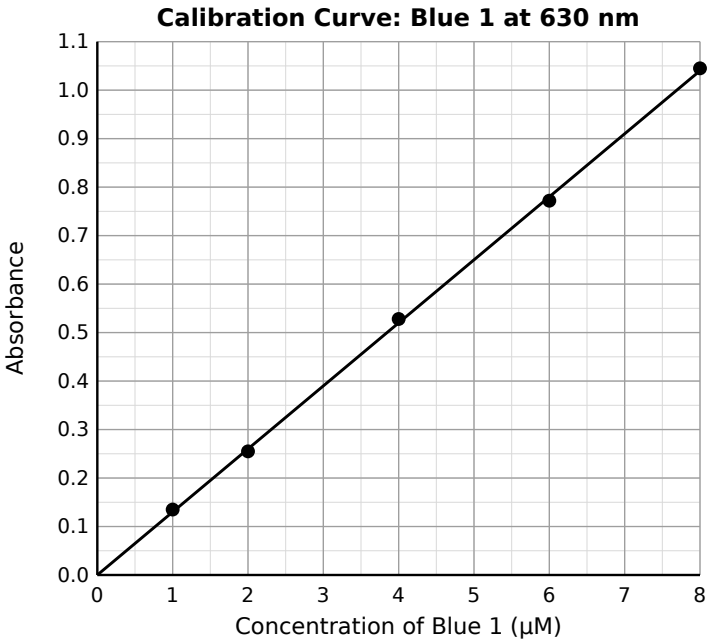
5. A student makes standard solutions of Blue 1 dye and measures the absorbance of each at 630 nm in a 1.00 cm cuvette. The data and best-fit line are graphed below. (1 μM = 1×10^{-6} M)



(a) Use two points on the best-fit line (not data points) to find the slope. Then determine ε for Blue 1. Include units.

(b) A sports drink sample has an absorbance of 0.455. Determine the concentration of Blue 1 in the drink, in M.

(c) A second drink gives an absorbance of 1.62. Explain why the student should dilute this sample and remeasure instead of extending the line to find its concentration.

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6. For each error, state whether the measured absorbance of the drink sample would be **too high** or **too low**, and whether the calculated concentration would be too high or too low. Explain.

(a) The student leaves fingerprints on the clear sides of the cuvette holding the drink sample.

(b) The student rinses the cuvette with distilled water but not with the drink sample, so water droplets remain inside when the sample is added.

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